

Session 8A: Non-indigenous Marine Species

Questions & Answers

Marjorie Wonham

Q: Am I correct in concluding that this unknown pathway is one of the ones you have already identified and not some completely mysterious one?

A: If there is another pathway out there I would love to know about it.

Q: Are there trends in the number of native species?

A: That would be a really good analysis to do, to look at how the reporting of native species increased over time in our same region and compare those patterns. That's actually one of the advantages that we have on the West Coast here compared to the East Coast, is that our major shipping pathways, which really opened up with the fur trade in the early 1800s and then the California Gold Rush starting in 1849. The arrival of those two major pathways was pretty much at the same time as biological surveys were beginning, so we can probably get a fairly good handle on those patterns in a way that you can't do in other parts of the world.

Q: You showed aquaculture, a number of introductions due to aquaculture, and it went up a little and you mentioned that perhaps that wasn't due to new aquaculture introductions but to spread. Could you talk a little more about...it is natural spread?

A: There are a lot of species for example that were introduced into San Francisco Bay with aquaculture that we didn't get up here that have since spread up, so an analogous example might be the green crab, although we really don't know how it really got there or some other species that have been able to disperse with currents up the coastline and so we still ascribe them to an original vector of oysters, but of course that is on a recent oyster flux into our area.

Q: Do you see this trend continuing and growing, increasing in numbers and species, as invasive species in the Puget Sound area?

A: That is a really good question. When do you think it would stop? I mean it seems to me that you could fit another 10 species into our area, you could probably fit another 20 or 30 or maybe another 100, and I am not sure that I know the magic number where we are going to be full or where species might start to get driven extinct. So as long as the pathways remain open, and remember that pathways continue to change through time, and the nature of the origin and the recipient areas continue to change through time. As long as these pathways stay open and as long as regions keep changing, I see no reason to believe invasions will stop.

Q: There are some eradication processes going on to curtail, have you seen any slowdown because of those?

A: For individual species yes, there are eradication programs in place. One of the best examples of physical eradications in Padilla Bay where the spartina population has been controlled through a great deal of back-breaking effort. Of course, there is a bio-control release program being developed in Willapa Bay also to control the spartina there. So you can anticipate for those individual species that are being intensively targeted, their spread may well reduce. I don't see control efforts as a way to slow the total number of introduced species arriving to our area because they are so labor intensive that it strikes me that in the same way that we put fluoride in the water to prevent cavities, we really ought to look at a prevention approach if we want to reduce the number of invaders in our area.

Q: I haven't read Jim Carlton's research, I did read Haligraph's associated with cysts and almost a conclusive tie to ballast water in Australia. So we can assume that it happens here, and we're pretty sure it has, do you have a best management practice approach to the introduced species problem?

A: So your first comment about there being a lot of cysts in ballast water...I would take that to mean that there are an awful lot of introduced species in our area that we probably don't know about. Especially once you get into the microorganisms, the bacteria, the viruses, the dinoflagellates they are probably here, who would know? We don't have that information yet, and it will be some time in coming, I think it will be very interesting. In terms of a best management practice, I guess I would just iterate again that it seems to me that we need to focus on prevention of these pathways, closing these pathways to the extent that we can, rather than trying to deal with species on an ad-hoc basis once they get here. And there is certainly a lot of investigations going on for ballast water at least to try figure out what the best approach to that will be.

Sarah Dudas

Q: You mentioned treatment of ballast water. Do we know that standard wastewater treatment practices are effective in killing larvae or seeds of non-native species (marine species in general) or just the freshwater exposures sufficient to do that?

A: For ballast water treatment there are studies going on right now looking at ultraviolet treatment of the water coming out of ballast to kill organisms and other studies as well just to determine if there are chemicals that can do this that won't harm the water if it is expelled.

Q: Since the Strait of Georgia and Puget Sound are so interconnected and water flows back and forth, has there been a joint cooperation between the US and Canada to form cooperative rules to govern the aquaculture industry because what's in one country could affect the other one without having different rules, different strictness on those rules?

A: There is collaboration between the US and Canada, there is a British Columbia/Washington Georgia Basin Task force which has focused interest on non-indigenous species, and there's also a bilateral agreement between the US and Canada governing stock imports, so the US and Canada are working together to minimize the exchange between the two.

Q: Given everything you know about these species, what would be your highest priority hit list for immediate concern and ecological risk?

A: Based on what I know, my major concern would be if any of the invasions are altering the competition structure or the trophic web transfers, just how these invasions are basically impacting the ecosystems that they come into. And also if there's certain habitats that are more invadable than others, that's one thing that I would love to have a chance to look at as well.

Q: But based on what you know right now, I mean like the oyster drill has been around for 100 years, and it's actually very slow growing and you can pick them up and get rid of them that way. The green crab for instance, is something that is going to be widely spread over a pretty quick period of time and could have very devastating impacts on both shellfish and crab fisheries, but some of the other species, do you have a feel for which ones should be our priority?

A: Well, one of my priorities is the varnish clam, which is my study subject and the main concern there is competition with other species. One of them being the Manila clam, which has economic importance. For the green crab, predation is a concern and also competition with other species just for resources like food. It really depends on the species that you are looking at as to what the actual ecological concern would be.

Q: Does the varnish clam compete directly with the native littleneck, which are lower on the intertidal?

A: There is actually a grad student in Washington who is working on that. She has done some very small-scale studies but hasn't been able to come up with anything definitive. That is actually what her thesis work is on, is looking at the competition effects.

Q: It seems like the advent of ballast water exchange on other ballast water control mechanisms is a great potential experiment to determine just what the importance of ballast water is as a pathway if you slowed it down. What would it take, do you think, to be able to detect a change in the rate of invasions coming in? What kind of a spatial and temporal scale would you have to look at to see an effect of shutting off that pathway?

A: I think that for the regions that ballast water seems to be the most important either because it has been studied more, because there are larger ports in San Francisco Bay and the Strait of Georgia, well, I am basically focusing on this because there is also a lot of studies that have been done in Australia. So maybe take those regions where it has been already studied and the distribution of that for more well known, and people have actually sampled ballast water, shut the pathway off, and see what happens. You'd have to do over such a long-time scale to actually see an impact, it would be decades I would think before you could see it.

Q: We are kind of Puget-centric here. Are there American species showing up in Asia?

A: I would imagine so. **Marjorie responds:** One that springs to mind is the comb-jelly, which is native to the Chesapeake Bay and was introduced to the Black Sea region probably in ballast water and its explosive growth there is certainly tightly correlated with a crash in the fish stocks there. The comb-jelly vacuums its way through the water column eating juvenile fish and juvenile fish food, but it is difficult to distinguish its impact from those of over harvesting. There are not many that have gone that we know have that have left this continent and gone elsewhere, although there was a lot of effort on the part of the Fisheries Bureau again at the early part of the century to import geoducks for example to Chesapeake Bay and a number of other Pacific shellfish species.

Sally Hacker

Q: You showed just that a little tiny percentage of the spartina is in the sandy cobbly beaches, and I am wondering if you think that it is likely to remain a player in those places or since those are dominant habitat types in all of Puget Sound, is that something we should be worrying about, is it likely to come to be important in those places?

A: Once it gets established it's something to worry about, but actually getting established in those areas takes some time, and it's because probably they are higher energy communities. They have more tidal action and it's harder to grow in rocks, compared to a mudflat, which is a much nicer place to grow if you are a spartina plant. But I do think that once it gets established, essentially what it does is it builds its own habitat on top of the cobble and once it does that, then it can really spread, so there are areas of concern, cobble beaches people should really be concerned about invasions that start there but actually getting started is much harder than it is in other places.

Q: Do you have any indication at all which of the four different kinds of habitats would have the highest success rate for removal of spartina?

A: Somebody is going to talk about that in a minute.

Q: [Partial question recorded]: Once they got here a lot of their spread was due to spread on recreational vessels, boats and trailers. How much is that a pathway for spartina spreading in our region?

A: I don't think it spreads much by boats. I think mostly through these floating raftthat get formed. Spartina seeds are incorporated in that and they end up moving around to various sites. The seeds can float on their own, they can make it into two new habitats pretty easily, so they are likely going to follow the patterns of currents and people are working on that. In fact, there's a poster here where people have done

some modeling to try to look at what the probability is that spartina will arrive in different places based on basically oil spill models, so I think mostly what it's doing is moving with those rafts and on its own too.

Q: Is there any spartina-specific fungus or disease that would help eradicate that?

A: There is a fungus...which affects the seed set, and it's actually...particularly in some areas in England...it has really devastated some of the spartina populations, and one of the things that they are noticing now because England has had this invasion for over 100 years, is that a lot of the sediment that has been caught up and the spartina is now being released out into shipping channels and changing the sedimentation patterns by a meter or two in some areas. So the die off has all these consequences, but there is this disease, there are insects that eat spartina, and people have been working on that, especially in Padilla Bay, looking at introducing insects as bio-control agents.

Tabitha Reeder

Q: Do you know how glyphosate actually kills the plant?

A: It interrupts the metabolism of spartina.

Q: Would you care to speculate on why the grass rack is so much more effective even after one year of treatment?

A: What I think is happening so far without looking at the physical factors is kind of hard to say, but what I think is happening is that it is basically smothering out the spartina that is underneath the rack, so the soil conditions may become too anoxic for spartina which can do some amazing things to the soil.

Q: Since spartina raises the substrate level, I am wondering if you have noticed that once the spartina is removed whether the substrate level goes down or whether you are stuck with a raised elevated level?

A: That's an interesting question. What's happening, there is some data that came out of England, when they do some removal and then you are left with a substrate that has been raised about a meter, when there isn't that compact root system holding that sediment in place, it washes back out with the waterways and it can be a really big problem.

Q: That spray that they use to eradicate spartina, does it have any environmental effects on the substrate or other plants?

A: There is some interesting research about that. Most people think that because it breaks down fairly quickly, within hours, about six hours, they say it tends not to have a big effect on the biology of the area, but that is something I would like to look into a bit more definitely.

Q: In your test sites you cleared an area away, could you have gotten regrowth and seed production from the area that you did not clear which increased your regrowth, but if you would have totally mowed down the whole site, would that decrease the percent of regrowth?

A: Sure, it could if you had fewer seedlings coming in. When I had them removed, they removed about 12 feet around an entire area, not just around a ¼-meter square plot, and I also kept track of seedlings that came in and this past summer. I didn't actually see a lot of seedlings that were coming in, but that can definitely be a factor.

Q: What removal method were you using, just the spraying for the actual removal or did you try pulling?

A: Actually I had Washington State Department of Agriculture use their methods so they actually went out and did the removal for me. What I really want to do is basically monitor how well their methods are working, so they went out, they sprayed first and then they mowed it down at the end of the summer.

Q: Can we conclude from what you said that most of the regrowth is resprouting and not new seedlings coming in?

A: Most of the regrowth is resprouting from the root system that is underneath those plots so it comes from the stubble that is still there.

Marjorie Wonham or Sarah Dudas

Q: Is there any evidence of the Asian clam in the Strait of Georgia or Puget Sound, and if not, do you expect it to show up?

A: There is not any records in the Strait of Georgia of the Asian clam, but there is some speculation that we might see it soon.

Tabitha Reeder

Q: Was there any torching tried rather than spraying and the effectiveness?

A: It is my understanding that they have tried torching in the past, they have tried burning with not a lot of success, but that's not their primary method of removal right now.

Q: It would be a spectacular restoration program if when you removed the spartina it was just native plants that moved back in and you mentioned that as one of your future research directions. Do you have any preliminary observations on the proportion of native and non-native plants that do come back in?

A: After the spartina raises the substrate, there are quite a few plants that do come in. I don't have any data on that yet though.